well as the mudesous acid itself, are oxidized and converted into a new brownish-yellow, soluble and deliquescent acid, containing more oxygen, and in the anhydrous state represented by $C_{12} H_5 O_{10}$.

6. That this new acid, the *mudesic*, combines readily with alumina and protoxide of mercury, giving salts of a yellow colour. Both the acids described in this paper are distinguished for their tendency to precipitate alumina and the protoxide of mercury. The mudesate of mercury dried at 300° F., is represented by $(2 H_9 O + C_{12} H_5 O_{10})$.

7. That chlorine, when made to act on either of the acids, or their salts of alumina in contact with water, gradually deprives them of all colour, while, at the same time, muriatic acid is formed. Collected on the filter, boiled in water till the washings cease to precipitate nitrate of silver, and dried, the white gelatinous, apparently altered mudesite or mudesate, is found on analysis to contain no atomic proportion of chlorine, but to have sensibly the constitution of the mudesic acid, or mudesates prepared by the direct action of nitric acid. The author thinks it not unlikely that a chloro-mudesic acid exists, and may be formed during this process, represented probably by $C_{12} H_4 Cl O_{10}$, but which he has not succeeded in obtaining in a separate state.

The mudesous and mudesic acids are distinguished from each other by giving, the former brown, and the latter yellow precipitates with the neutral metallic salts—by being the former unaltered, and the latter deliquescent in the air. Both form deliquescent salts with ammonia, and appear to undergo alteration by the long-continued action of hydrosulphuric, or of concentrated sulphuric and hydrofluoric acids.

7. On the Constitution of the Resins, Part V. By James F. W. Johnston, Esq., M.A., F.R.S.

In this paper the author continues his examination of what are called the fetid resins, and from repeated analyses deduces for the resin of Sagapenum the formula $C_{40} H_{29} O_9$, and for that of Galbanum $C_{40} H_{27} O_7$. He then compares the formulæ for the four resins :

Opoponax $= C_{40} H_{25} O_{14}$, Assafœtida $= C_{40} H_{26} O_{10}$,
Galbanum $= C_{40} H_{27} O_{70}$, Sagapenum $= C_{40} H_{29} O_9$;

and considers it probable that, though no striking analogy among the *irrational* formulæ for these resins is perceptible, by which their analogy in physical properties can be accounted for, that they may possess an analogous *rational* constitution, which future researches may disclose.

Euphorbium consists of two resins, of which the more soluble, A, gave the formula $C_{40} H_{31} O_6$. Elemi also consists of two resins, of which the more soluble, A, is represented by $C_{40} H_{32} O_4$, and the less soluble, B, by $C_{40} H_{32} O_1$, as had previously been shown by Hess and Rose. The Bdellium of commerce contains much gum, and a resin $C_{40} H_{31} O_5$.

The resin of Benzoin presented peculiar difficulties when submitted to investigation, from the ease with which it undergoes de-

composition, even at temperatures much below that at which it melts. With regard to this resin, the author gives the following as the result of his numerous analyses:—

1. That the colourless resin of benzoin is represented approximately by $C_{40} H_{22} O_9$.

2. That by heat and dilute carbonated alkalies it is decomposed into water, benzoic acid, a little volatile oil, and a resin $C_{40} H_{23} O_9$, or $C_{40} H_{24} O_9$.

3. That by boiling with quicklime, or concentrated carbonated alkalies, it gives two resins, one in large quantity $= C_{40} H_{24} O_8$; and another in small quantity $= C_{40} H_{30} O_7$.

4. That by caustic potash the crude resin is resolved into two resins represented respectively by $C_{40} H_{22} O_9$, and $C_{40} H_{30} O_7$, of which the former is precipitated, and the latter remains in solution, when a saturated aqueous solution of caustic potash is added to an alcoholic solution of the crude resin.

5. And that by oxide of lead two resins are separated, for which analysis gave respectively the formulæ $C_{40} H_{22} O_9$ and $C_{40} H_{26} O_{10}$.

The author concludes by stating that such metamorphoses are by no means confined to this resin, though the more accurate knowledge of their nature, obtained by the imperfect study he has made of the resin of benzoin, has explained many anomalies he had previously observed, with regard to the relations of the resins to the alkalies and metallic oxides. He considers the group of which dragon's blood is the type, and which he represents by the expression $C_{40} H_{24} \pm x O_9$ to be peculiarly susceptible of modification (or decomposition?) by the action of bases; and he specifies among other results, with regard to which it is his intention to address the Society in a future paper, that dragon's blood, of which the lump variety $= C_{40} H_{21} O_8$, and the drop variety (heated to 300° F.) $= C_{40} H_{20} O_8$, gives by the action of quicklime and oxide of lead, among other products, two resins represented approximately by $C_{40} H_{20} O_{10}$ and $C_{40} H_{20} O_{12}$?—that guiacum $= C_{40} H_{23} O_{10}$, with oxide of lead, gives a resin $= C_{40} H_{21} O_{11}$, the resin of jalap $= C_{40} H_{34} O_{18}$; by the action of the same oxide, a resin $= C_{40} H_{34} O_{20}$, and that of assafœtida $= C_{40} H_{26} O_{10}$, a new resin $= C_{40} H_{23} O_{13}$. These metamorphoses lead to the second great branch of inquiry respecting the nature and constitution of the resins. Certain results being established, at least approximately, with regard to the *irrational* constitution of the resins, and certain general irrational formulæ by which to express it, we are prepared for the study of their *rational* constitution. This part of the subject the author proposes to consider farther in subsequent communications.

8. Researches on the Tides. Twelfth Series. On the Laws of the Rise and Fall of the Sea's surface during each tide. By the Rev. W. Whewell, B.D., F.R.S., Fellow of Trinity College, Cambridge.

The materials of the present investigation are five months' tide observations made at Plymouth; three months observations made